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Kitahara et al.

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(54) **DISPLAY CONTROL DEVICE**

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G09G 5/377	(2006.01)
G09G 5/14	(2006.01)

(Continued)

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CPC ***G09G 5/377*** (2013.01); ***G09G 5/14*** (2013.01); ***H04N 7/142*** (2013.01); ***H04N 7/147*** (2013.01); ***H04N 21/4223*** (2013.01); ***H04N 21/4316*** (2013.01); ***H04N 21/43635*** (2013.01); ***H04N 21/4854*** (2013.01); ***H04N 21/4856*** (2013.01); *G09G 2340/0442* (2013.01); *G09G 2370/12* (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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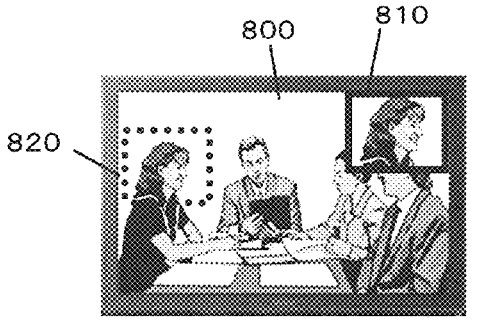
(57) **ABSTRACT**

A display control device of the present disclosure is a device for controlling a video image displayed on a display unit. The display control device includes a controller configured to generate an image including a first image and a second image superimposed on the first image to display the image on the display unit. The controller performs control to display the first image of a first field angle on the display unit when a first mode is set, and performs control to display the first image of a second field angle which is wider than the first field angle on the display unit when a second mode is set. The second mode is a mode for setting a region of the second image in a region of the first image of the second field angle.

6 Claims, 13 Drawing Sheets



(51) **Int. Cl.**

H04N 7/14	(2006.01)
H04N 21/4223	(2011.01)
H04N 21/431	(2011.01)
H04N 21/4363	(2011.01)
H04N 21/485	(2011.01)

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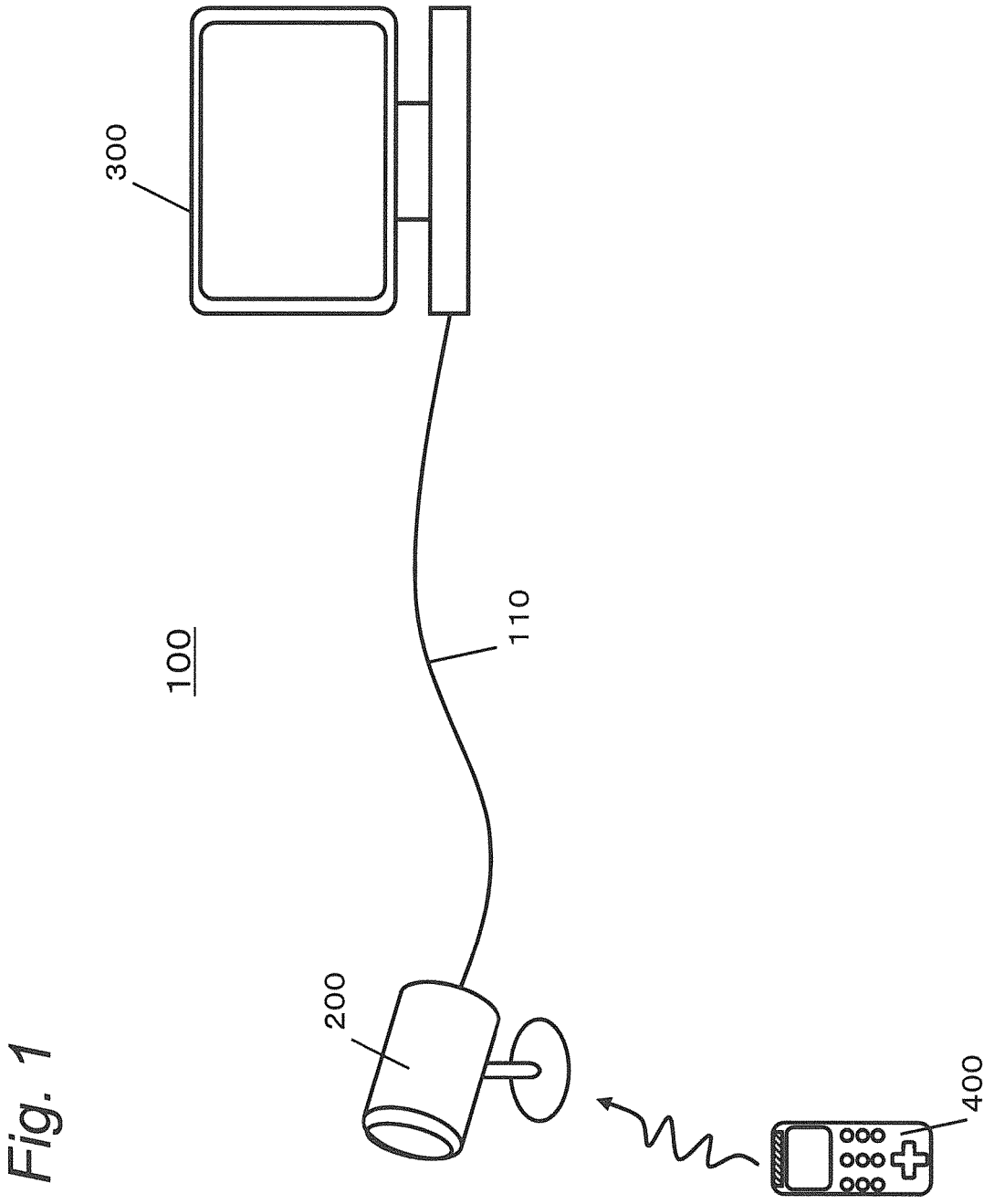


Fig. 1

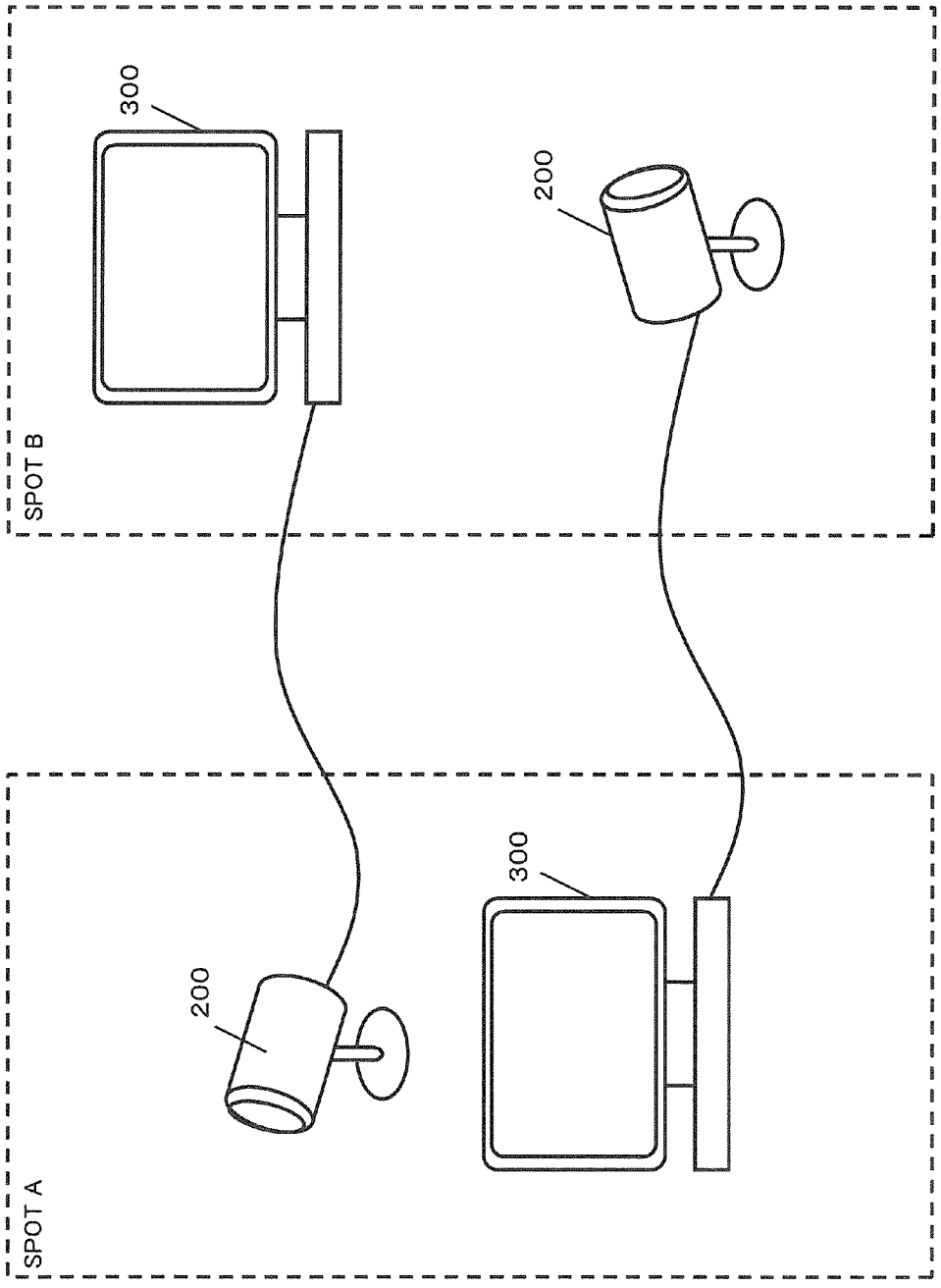


Fig. 2

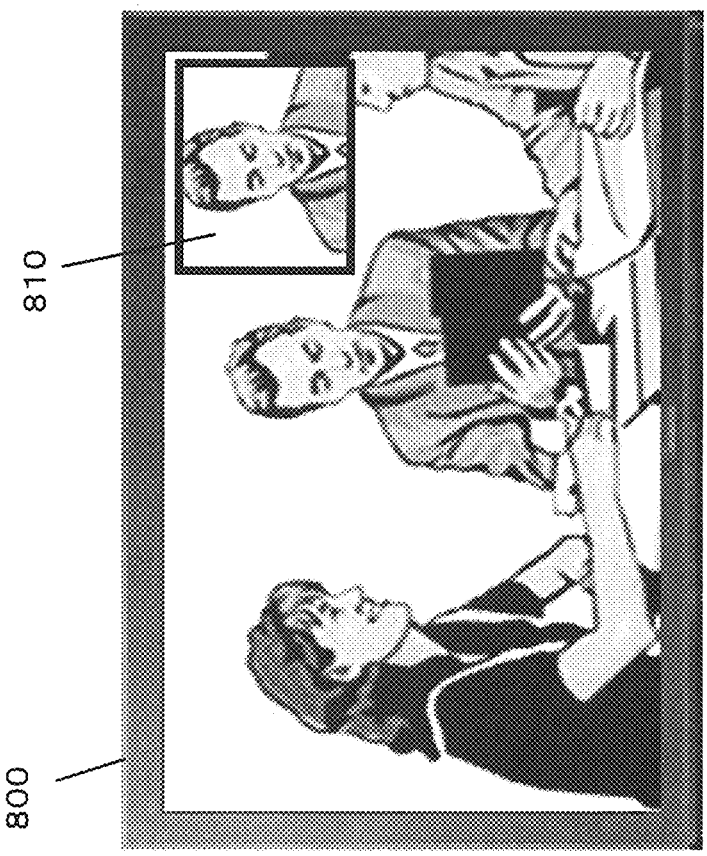


Fig. 3

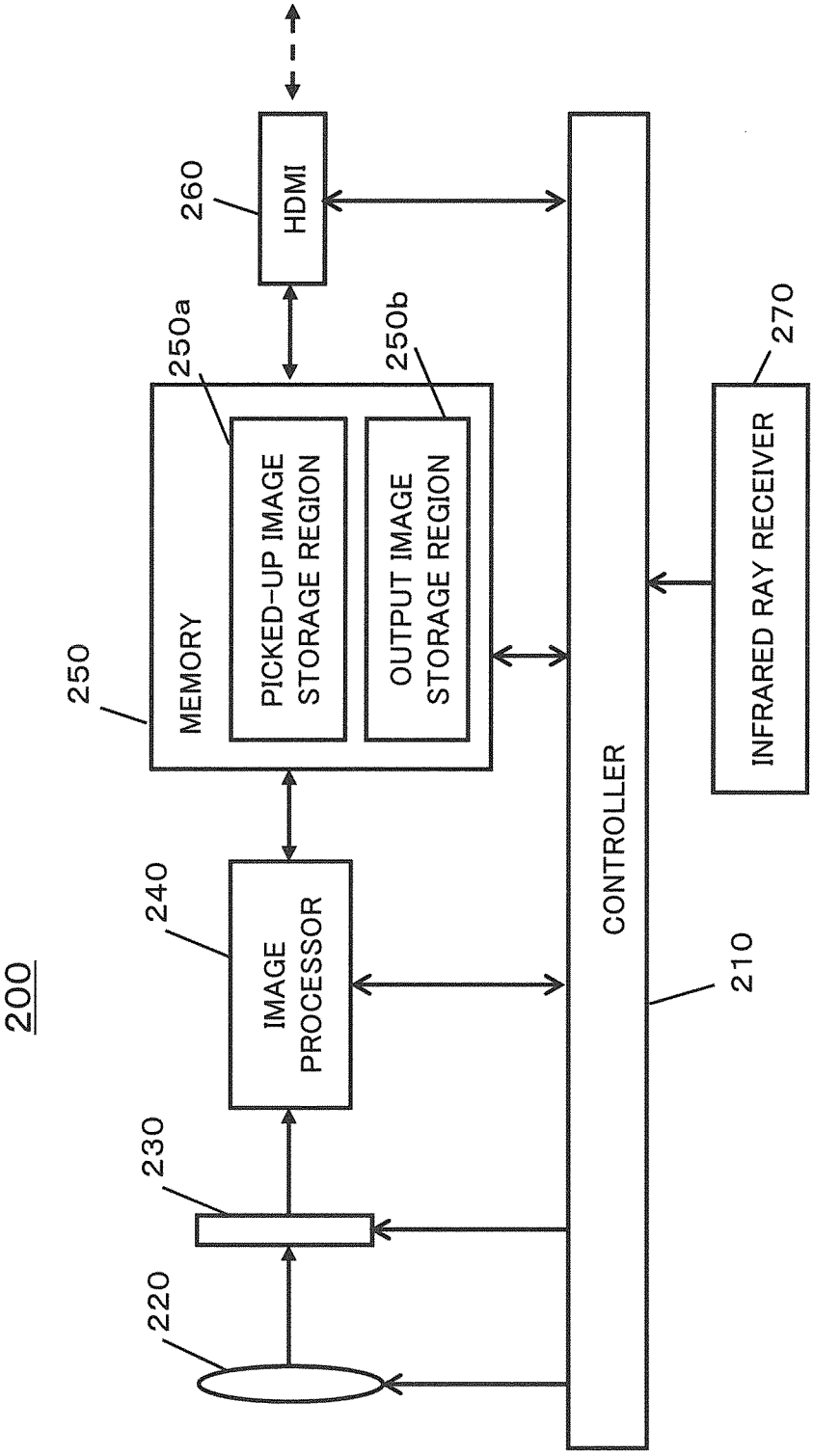

200
220
230
240
IMAGE PROCESSOR
250
MEMORY
250a
PICKED-UP IMAGE STORAGE REGION
250b
OUTPUT IMAGE STORAGE REGION
260
HDMI
270
INFRARED RAY RECEIVER
CONTROLLER
210

Fig. 4

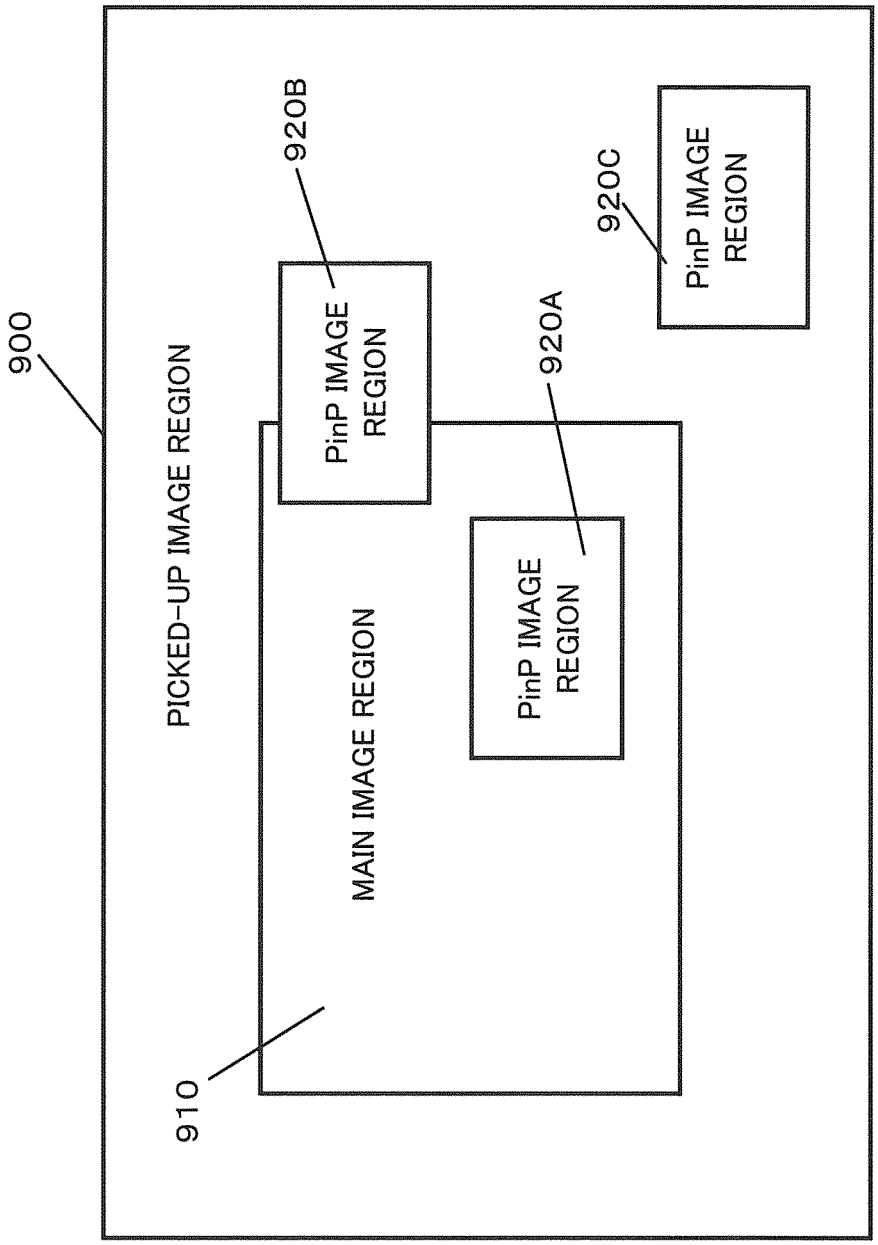

900
PICKED-UP IMAGE REGION
920B
PinP IMAGE REGION
920C
PinP IMAGE REGION
920A
PinP IMAGE REGION
MAIN IMAGE REGION
910

Fig. 5

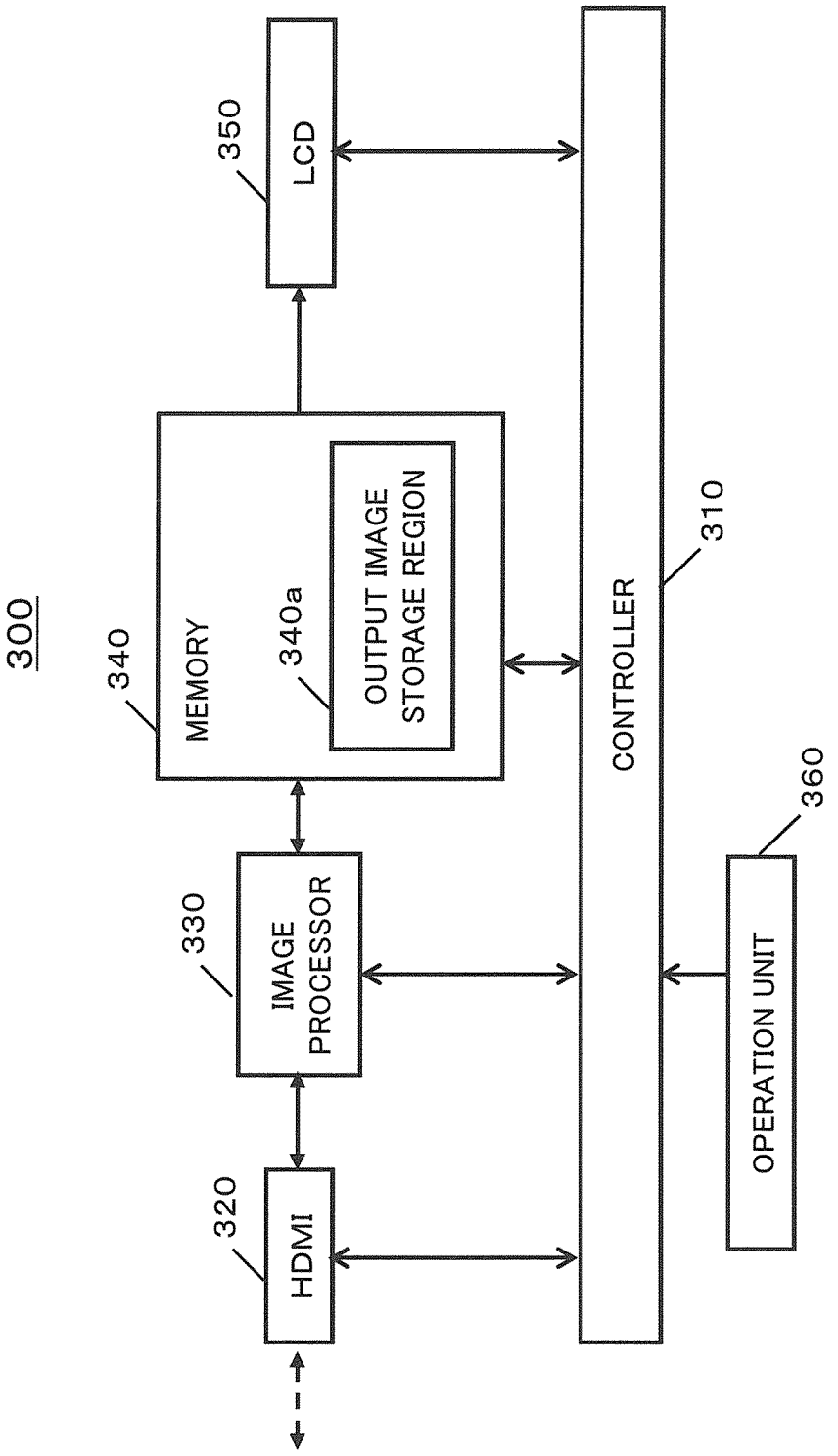

300
350
LCD
340
MEMORY
340a
OUTPUT IMAGE STORAGE REGION
310
CONTROLLER
330
IMAGE PROCESSOR
360
OPERATION UNIT
320
HDMI

Fig. 6

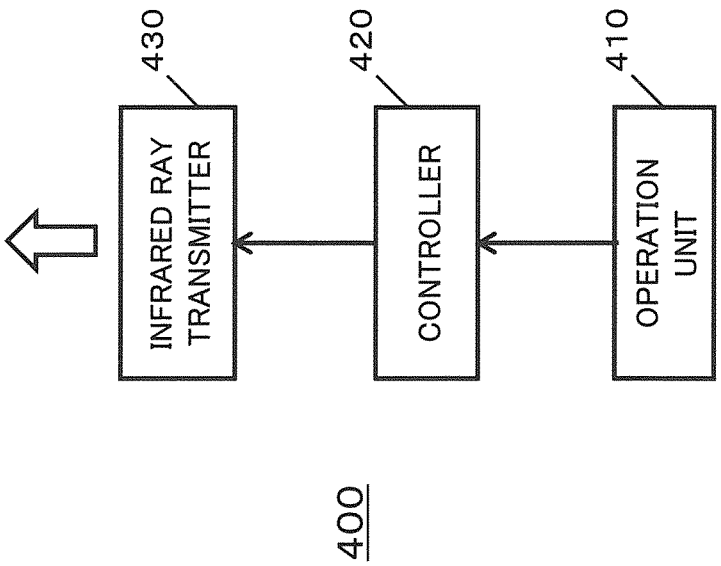

430
420
410
INFRARED RAY TRANSMITTER
CONTROLLER
OPERATION UNIT
400

Fig. 7

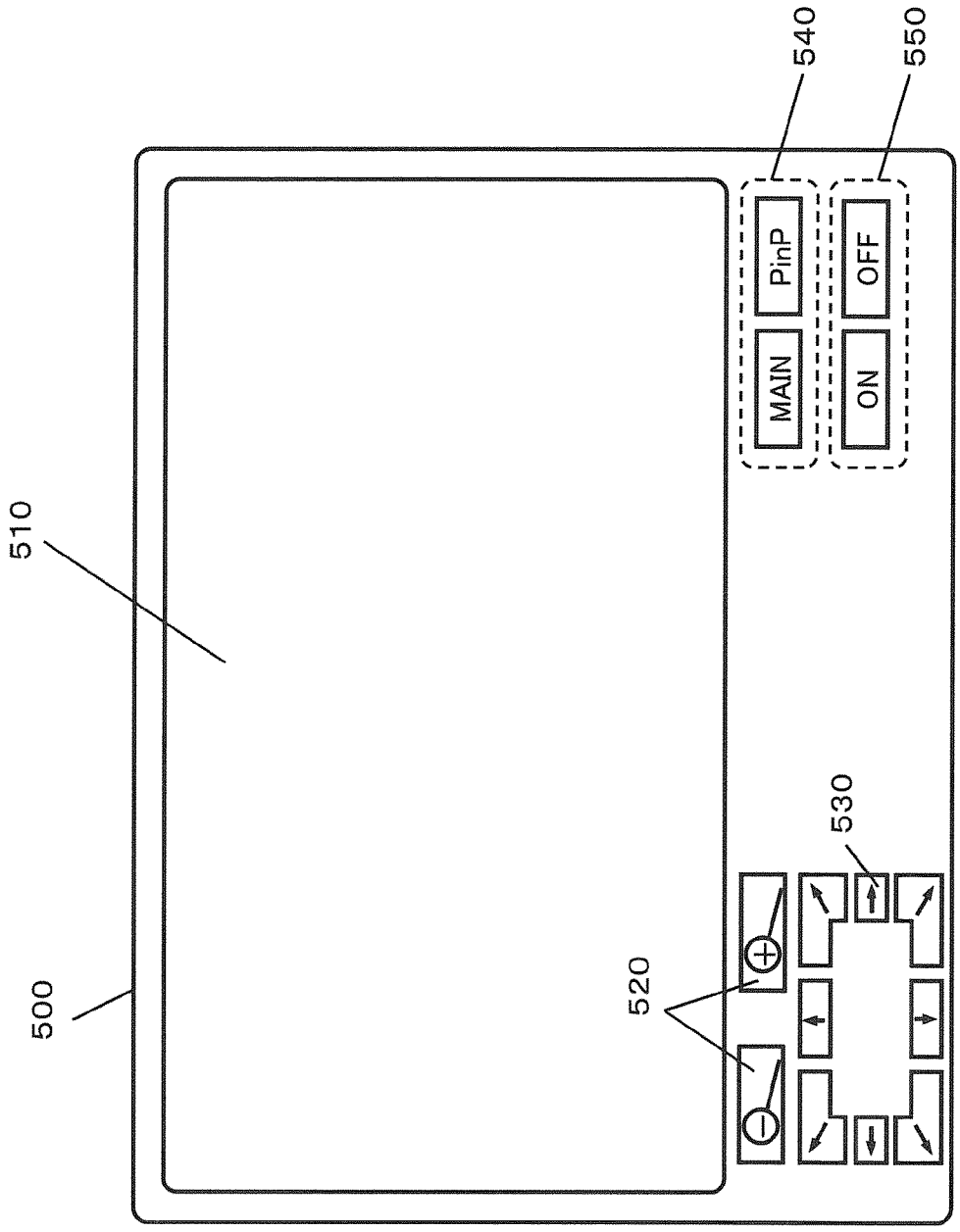


Fig. 8

Fig. 9

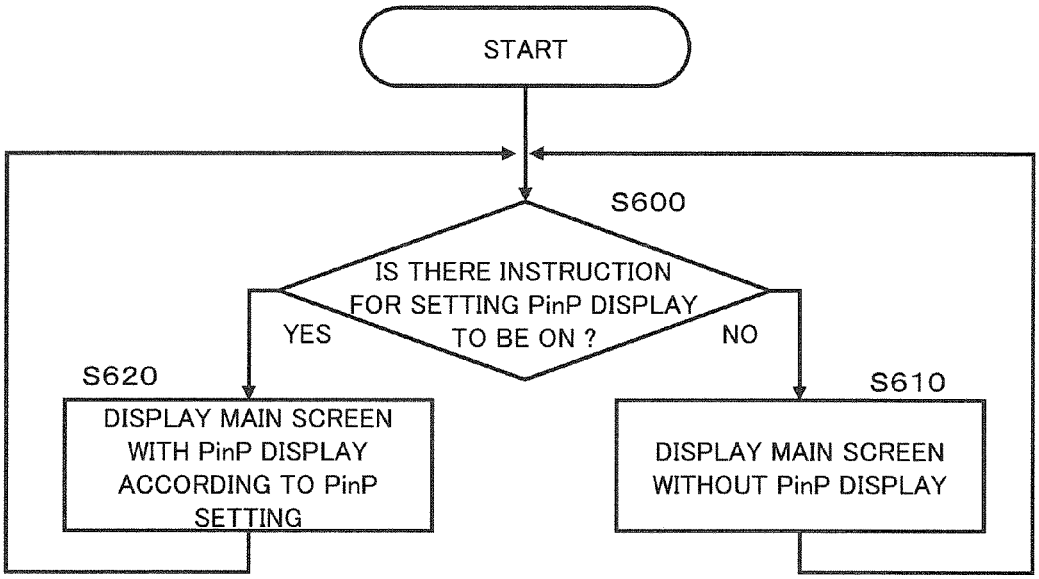

START
S600
IS THERE INSTRUCTION FOR SETTING PinP DISPLAY TO BE ON ?
YES
NO
S620
DISPLAY MAIN SCREEN WITH PinP DISPLAY ACCORDING TO PinP SETTING
S610
DISPLAY MAIN SCREEN WITHOUT PinP DISPLAY

Fig. 10

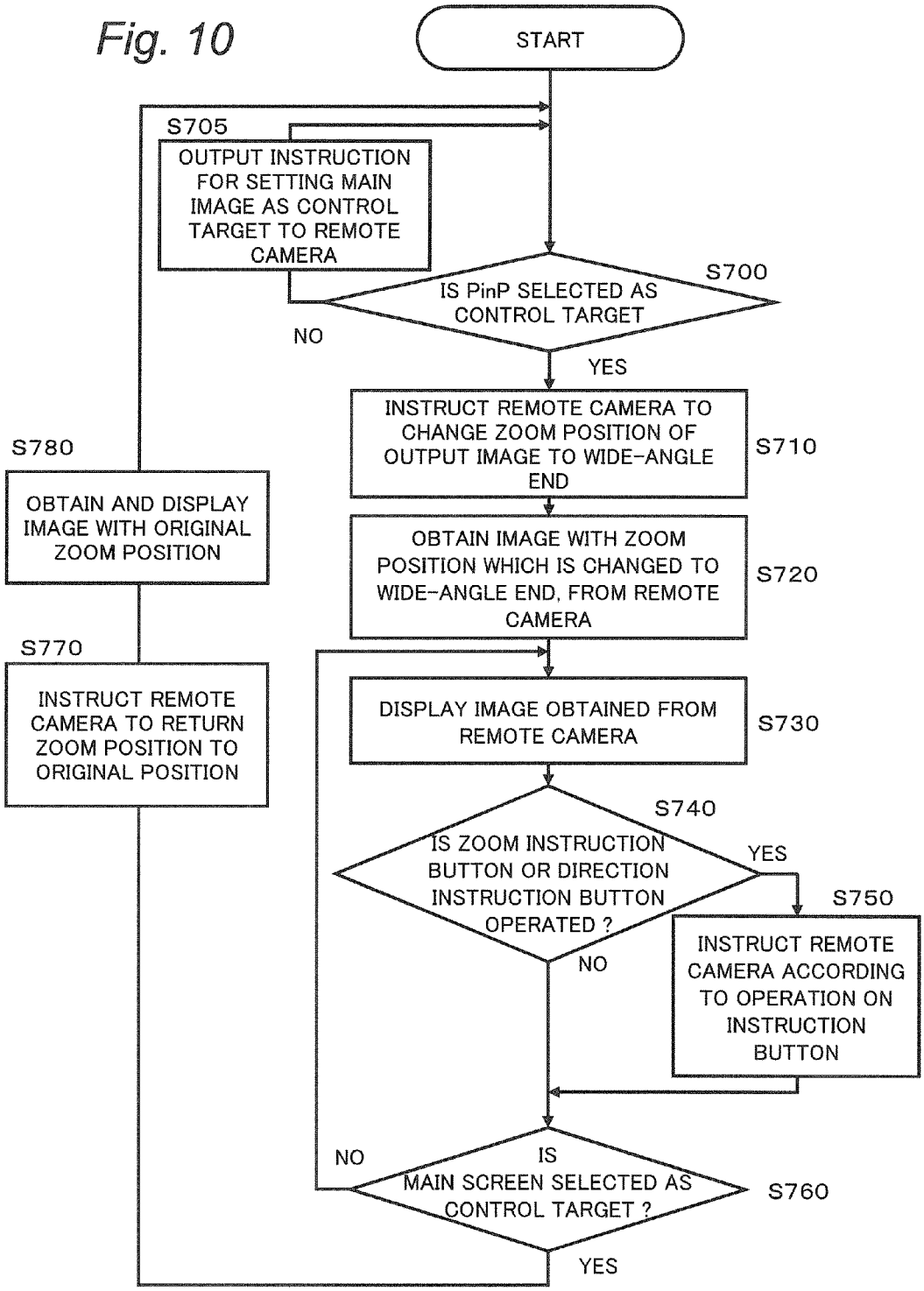

START
S705
OUTPUT INSTRUCTION FOR SETTING MAIN IMAGE AS CONTROL TARGET TO REMOTE CAMERA
S700
IS PinP SELECTED AS CONTROL TARGET
NO
YES
INSTRUCT REMOTE CAMERA TO CHANGE ZOOM POSITION OF OUTPUT IMAGE TO WIDE-ANGLE END
S710
OBTAIN IMAGE WITH ZOOM POSITION WHICH IS CHANGED TO WIDE-ANGLE END, FROM REMOTE CAMERA
S720
DISPLAY IMAGE OBTAINED FROM REMOTE CAMERA
S730
S740
IS ZOOM INSTRUCTION BUTTON OR DIRECTION INSTRUCTION BUTTON OPERATED ?
YES
NO
S750
INSTRUCT REMOTE CAMERA ACCORDING TO OPERATION ON INSTRUCTION BUTTON
NO
IS MAIN SCREEN SELECTED AS CONTROL TARGET ?
S760
YES
S780
OBTAIN AND DISPLAY IMAGE WITH ORIGINAL ZOOM POSITION
S770
INSTRUCT REMOTE CAMERA TO RETURN ZOOM POSITION TO ORIGINAL POSITION

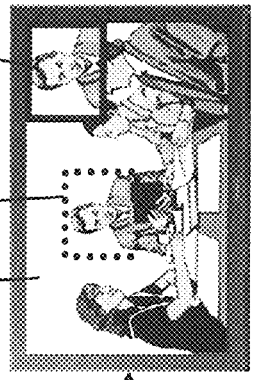
Fig. 11A

CONTROL TARGET : MAIN SCREEN
PinP DISPLAY : OFF

Fig. 11B

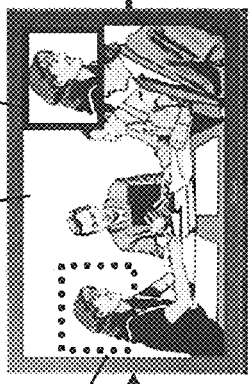
CONTROL TARGET : MAIN SCREEN
PinP DISPLAY : ON

Fig. 11C



CONTROL TARGET : PinP SCREEN
PinP DISPLAY : ON
INDICATE READING POSITION OF PinP WITH FRAME

Fig. 11D

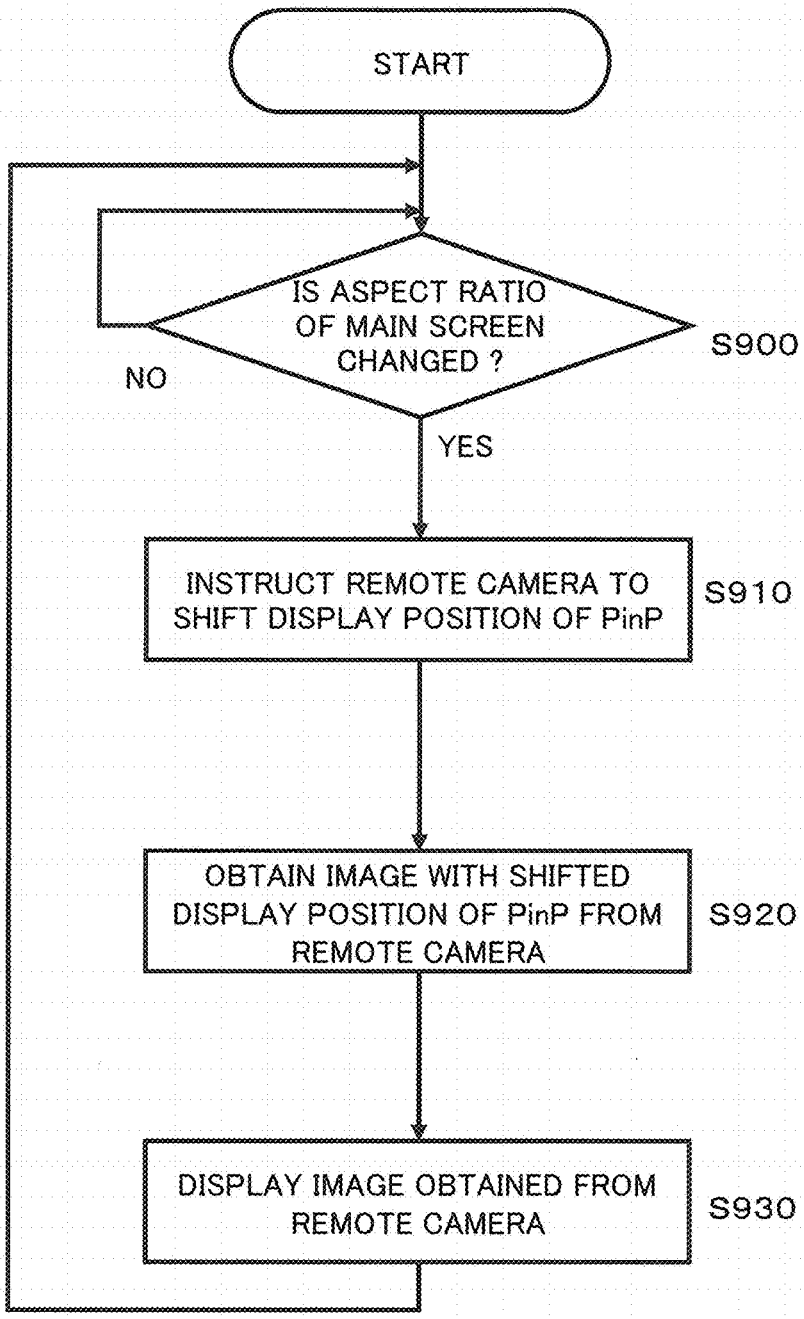


CONTROL TARGET : PinP SCREEN
PinP DISPLAY : ON
TRANSFER READING POSITION OF PinP

Fig. 11E

CONTROL TARGET : MAIN SCREEN
PinP DISPLAY : ON

Fig. 12


START
IS ASPECT RATIO OF MAIN SCREEN CHANGED ?
S900
NO
YES
INSTRUCT REMOTE CAMERA TO SHIFT DISPLAY POSITION OF PinP
S910
OBTAIN IMAGE WITH SHIFTED DISPLAY POSITION OF PinP FROM REMOTE CAMERA
S920
DISPLAY IMAGE OBTAINED FROM REMOTE CAMERA
S930

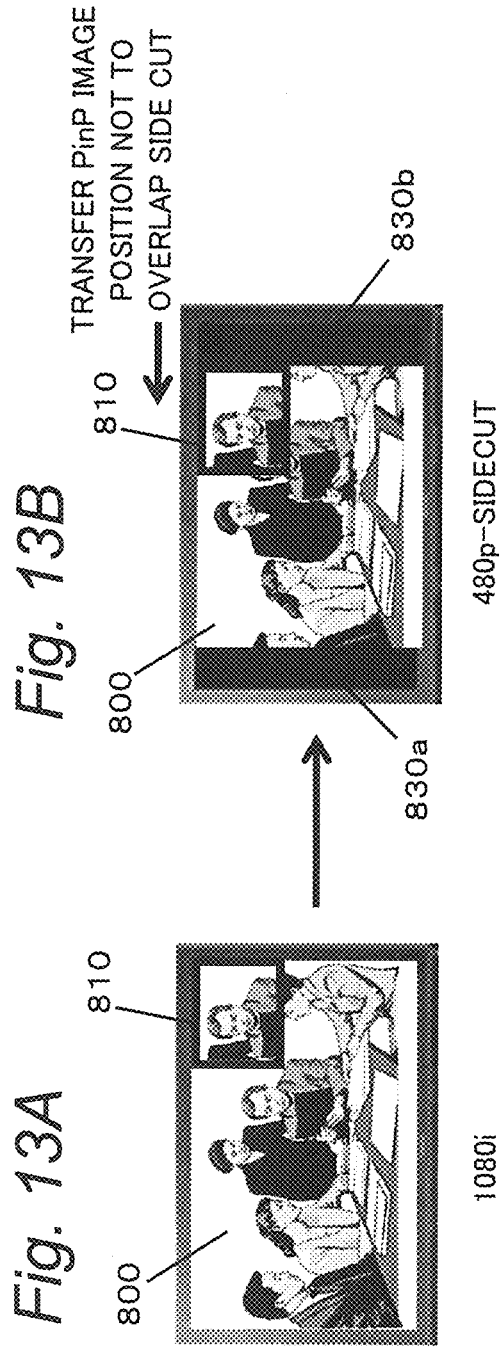


Fig. 13A
800
810
1080i
Fig. 13B
800
810
TRANSFER PinP IMAGE POSITION NOT TO OVERLAP SIDE CUT
830a
830b
480p-SIDECUT

DISPLAY CONTROL DEVICE

BACKGROUND

1. Technical Field

The present disclosure relates to a display control device having a PinP (Picture in Picture) function.

2. Related Art

A display control device that has a PinP (Picture in Picture) function for displaying one image on another image is known. For example, JP 09-163260 A discloses a television receiver for displaying an image of one broadcast program and an image of another broadcast program simultaneously broadcasted from different telecast stations on one screen. In JP 09-163260 A, an image of one broadcast program is a master image, and an image of the other broadcast program is a slave image so that PinP display is performed.

SUMMARY

The present disclosure provides a display control device that can perform more preferable PinP display.

A display control device of the present disclosure is a device for controlling a video image displayed on a display unit. The display control device includes a controller configured to generate an image including a first image and a second image superimposed on the first image to display the image on the display unit. The controller performs control to display the first image of a first field angle on the display unit when a first mode is set, and performs control to display the first image of a second field angle which is wider than the first field angle on the display unit when a second mode is set. The second mode is a mode for setting a region of the second image in a region of the first image of the second field angle.

The display control device of the present disclosure enables more preferable PinP display.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a configuration diagram of a video teleconference system according to the present embodiment.

FIG. **2** is a diagram illustrating a use form of the video teleconference system in which two spots are connected with each other.

FIG. **3** is a diagram describing a PinP display function for displaying a PinP image on a main image.

FIG. **4** is an electrical configuration diagram of a remote camera.

FIG. **5** is a diagram describing a picked-up image region, a main image region, and a PinP image region.

FIG. **6** is an electrical configuration diagram of a display device.

FIG. **7** is an electrical configuration diagram of an infrared remote controller.

FIG. **8** is a diagram describing an operation screen for operating the remote camera.

FIG. **9** is a flowchart illustrating an operation of the display device at a time when a PinP display selection button is operated.

FIG. **10** is a flowchart illustrating an operation of the display device at a time when a control target selection button is operated.

FIGS. **11**A to **11**E are diagrams describing screen transition at the time when the control target selection button is operated.

FIG. **12** is a flowchart illustrating an operation of the display device at a time when an output aspect ratio during HDMI output is switched.

FIGS. **13**A and **13**B are diagrams describing screen transition at a time when the output aspect ratio is switched.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Embodiments will be described in detail below by referring to the drawings as necessary. Note, however, that an unnecessarily detailed description may be omitted. For example, a detailed description of already well-known matters or an overlapping description of substantially the same configuration may be omitted. This is to avoid the following description from unnecessarily becoming redundant and facilitate understanding by those skilled in the art. Note that the inventor provides the accompanying drawings and the following description in order for those skilled in the art to thoroughly understand the present disclosure, and thus, it is not intended that the subject matter described in the claims is limited thereby.

First Embodiment

FIG. **1** is a configuration diagram of a video teleconference system according to a first embodiment. As shown in FIG. **1**, a video teleconference system **100** according to the first embodiment includes a remote camera **200**, and a display device **300** connected with the remote camera **200** via an HDMI cable **110**.

FIG. **2** is a diagram illustrating a configuration at a time when two spots A and B are connected with each other in the video teleconference system **100** according to the first embodiment. The remote camera **200** and the display device **300** may be connected with each other via a network between the two spots A and B.

In the video teleconference system **100**, an operation of an infrared remote controller **400** on the remote camera **200** or an operation of the display device **300** can control display of a PinP image to be displayed on the display device **300**. Herein, the PinP image refers another image **810** to be displayed on a main image **800** as shown in FIG. **3**. The video teleconference system **100** according to the present embodiment has a PinP display function for displaying such a PinP image as well as the main image **800** on the display device **300**.

A configuration and an operation of the video teleconference system **100** are sequentially described below.

1-1. Configuration

1-1-1. Remote Camera

FIG. **4** is an electrical configuration diagram of the remote camera **200**. The configuration of the remote camera **200** is described with reference to FIG. **4**.

As shown in FIG. **4**, the remote camera **200** includes a controller **210**, a lens **220**, a CMOS image sensor **230**, an image processor **240**, a memory **250**, an HDMI interface **260**, and an infrared ray receiver **270**.

The controller **210** generally controls an entire operation of the remote camera **200**. The controller **210** includes a ROM (not shown) for storing information such as programs, and a CPU (not shown) for processing the information such as programs. The ROM stores programs relating to lens control and digital zoom control, and programs for generally controlling the entire operation of the remote camera **200**. The controller **210** transmits a control signal to the CMOS image sensor **230**, the image processor **240**, and the like based on a vertical synchronizing signal (VD). The controller **210** may be implemented by a hard-wired electronic circuit, a microcomputer, or the like. Further, the controller **210** as well as the

image processor **240** described later, may be implemented as one integrated circuit. Note that the ROM does not have to be an internal component of the controller **210**, and may be provided to the outside of the controller **210**.

The lens **220** includes an optical system such as a focus lens. The remote camera **200** may include a zoom lens, a diaphragm, a mechanical shutter, and an optical hand shake correcting lens, which are not shown in FIG. **4**. Various lenses included in the lens **220** may be implemented by any number of lenses or any number of lens groups.

The CMOS image sensor **230** captures a subject image formed through the lens **220** to generate image data. The CMOS image sensor **230** generates image data of a new frame at a predetermined frame rate (for example, 30 frames/sec). Image data generating timing and an electronic shutter operation of the CMOS image sensor **230** are controlled by the controller **210**. Instead of the CMOS image sensor **230**, another image pickup device, such as a CCD image sensor or an NMOS image sensor, may be used.

The image processor **240** executes various image processes on image data output from the CMOS image sensor **230**. Examples of the various processes are gamma correction, white balance correction, a YC converting process, an electronic zooming process, a compressing process, and an expanding process, but the various processes are not limited to them. The image processor **240** may be implemented by a hard-wired electronic circuit, a microcomputer for executing programs for executing these processes, or the like. Further, the image processor **240** as well as the controller **210** and the like may be implemented as one integrated circuit.

The memory **250** is a recording medium that functions as a work memory of the controller **210** and the image processor **240**. The memory **250** can be implemented by a DRAM (Dynamic Random Access Memory). The memory **250** has a picked-up image storage region **250***a*, and an output image storage region **250***b*. The picked-up image storage region **250***a* is a storage region for temporarily storing an image captured by the CMOS image sensor **230**. The output image storage region **250***b* is a storage region for temporarily storing an image to be output to the display device **300**. Note that, in this example, a partial region of the image picked up by the CMOS image sensor **230** is the image to be output to the display device **300**. For this reason, a field angle of the image captured by the CMOS image sensor **230** is larger than a field angle of the image to be output to the display device **300**.

The HDMI interface **260** is a communication interface for performing communication compliant with the HDMI (High-Definition Multimedia Interface) standards. The HDMI interface **260** can transmit various digital signals of images, sounds, and the like bidirectionally. The HDMI interface **260** is electrically connected to a HDMI of an other electronic device via the HDMI cable **110**. That is to say, the remote camera **200** is electrically connected to an other electronic device (the display device **300** or the like) via the HDMI cable **110**. As a result, the remote camera **200** can transmit various digital signals of images, sounds, and the like to an other electronic device or can receive various digital signals of control commands and the like from an other electronic device. Note that, instead of the HDMI interface **260**, an other connecting unit such as a wired LAN (Local Area Network) or a wireless LAN may be used.

The infrared ray receiver **270** is an interface for receiving an infrared signal from the infrared remote controller **400**. The infrared signal received by the infrared ray receiver **270** is transmitted to the controller **210**. The controller **210** performs various controls based on the received infrared signals. The infrared ray receiver **270** is not a component that is essential for the remote camera **200**. However, the infrared ray receiver **270** enables the reception of the infrared signals transmitted from the infrared remote controller **400**, and can provide a plurality of operating methods to a user.

1-1-1-1. Image Region in Picked-Up Region

FIG. **5** is a diagram for describing the respective regions to be used for display in the entire image region captured by the CMOS image sensor **230**. A picked-up image region **900** is an entire region of the image region obtained by imaging through the CMOS image sensor **230**. A main image region **910** is a partial region of the picked-up image region **900**, and is an image region to be adopted (displayed) as a main screen on the display device **300** when the main image **800**, described later, is selected as a control target. PinP image regions **920**A to **920**C are examples of the image regions that are adopted (displayed) out of the picked-up image region **900** as the PinP image on the display device **300**. FIG. **5** illustrates variations **920**A to **920**C of the image region that can be adopted as the PinP image regions. The PinP image region **920**A is an example in a case where the PinP image region contained completely in the main image region **910** is set. The PinP image region **920**B is an example in a case where the PinP image region is set to be partially overlapped with the main image region **910**. The PinP image region **920**C is an example in a case where an image region outside the main image region **910** is set as the PinP image region. In this manner, in the video teleconference system **100**, a partial region of the picked-up image region **900** is cut out as the PinP image region to be displayed on the display device **300**. That is to say, in the mode for setting the PinP image region, described later, both outside region and inside region of the main image region **910** can be adopted as the PinP image region in the picked-up image region **900** if each of the outside region and the inside region is within the region of the main image **800** that is shifted to a wide-angle end. As a result, suitable PinP images can be displayed according to applications of the video teleconference system **100**.

1-1-2. Display Device

FIG. **6** is an electrical configuration diagram of the display device **300**. The configuration of the display device **300** is described with reference to FIG. **6**.

As shown in FIG. **6**, the display device **300** includes a controller **310**, an HDMI interface **320**, an image processor **330**, a memory **340**, a liquid crystal display **350**, and an operating section **360**.

The controller **310** generally controls the entire operation of the display device **300**. The controller **310** includes a ROM (not shown) for storing information such as programs, and a CPU (not shown) for processing the information such as programs. The ROM stores a program relating to display control, and programs for generally controlling the entire operation of the display device **300**. The controller **310** transmits a control signal to the image processor **330**, the liquid crystal display **350**, and the like based on a vertical synchronizing signal (VD). The controller **310** may be implemented by a hard-wired electronic circuit, a microcomputer, or the like. Further, the controller **310** as well as the image processor **330** described later and the like may be implemented as one integrated circuit. The ROM does not have to be the internal component of the controller **310**, and may be provided to the outside of the controller **310**.

The HDMI interface **320** is a communication interface for performing communication compliant with the HDMI standards. The HDMI interface **320** can transmit various digital signals of images, sounds, and the like bidirectionally. The HDMI interface **320** is electrically connected to an HDMI of an other electronic device via the HDMI cable **110**. That is to

say, the display device **300** is electrically connected to an other electronic device (the remote camera **200** or the like) via the HDMI cable **110**. As a result, the display device **300** can receive various digital signals of images, sounds, and the like from an other electronic device, and can transmit various digital signals of control commands and the like to an other electronic device. Note that, instead of the HDMI interface **320**, an other connecting unit such as a wired LAN (Local Area Network) or a wireless LAN may be used.

The image processor **330** executes various image processes on image data obtained via the HDMI interface **320**. Examples of the various processes are gamma correction, white balance correction, a YC converting process, an electronic zooming process, a compressing process, and an expanding process, but the various processes are not limited to them. The image processor **330** may be implemented by a hard-wired electronic circuit, a microcomputer for executing programs for executing these processes, or the like. Further, the image processor **330** as well as the controller **310** and the like may be implemented as one integrated circuit.

The memory **340** is a recording medium that functions as a work memory of the controller **310** and the image processor **330**. The memory **340** can be implemented by a DRAM (Dynamic Random Access Memory) or the like. The memory **340** has an output image storage region **340***a*. The output image storage region **340***a* is a storage region for temporarily storing an image to be output to the liquid crystal display **350**.

The liquid crystal display **350** displays an image processed by the image processor **330** and stored in the output image storage region **340***a* in the memory **340**. Note that, instead of the liquid crystal display **350**, an other display device such as an organic EL display or the like may be used.

The operation unit **360** is a general term for a keyboard, a mouse, and/or the like provided to the display device **300**, and receives user's operations. When receiving user's operations, the operation unit **360** transmits various operation instructing signals to the controller **310**.

1-1-3. Infrared Remote Controller

FIG. **7** is an electrical configuration diagram of the infrared remote controller **400**. A configuration of the infrared remote controller **400** is described with reference to FIG. **7**.

As shown in FIG. **7**, the infrared remote controller **400** includes an operation unit **410**, a controller **420**, and an infrared ray transmitter **430**.

The operation unit **410** is a general term for a cross key, number keys, and/or the like provided to the infrared remote controller **400**, and receives user's operations. When receiving user's operation, the operation unit **410** transmits various operation instructing signals to the controller **420**.

The controller **420** generally controls an entire operation of the infrared remote controller **400**. The controller **420** generates a control signal based on the operation instructing signals received by the operation unit **410**. The controller **420** transmits the generated control signal to the infrared ray transmitter **430**.

The infrared ray transmitter **430** is an interface for transmitting an infrared signal to the infrared ray receiver **270** of the remote camera **200**. The infrared ray transmitter **430** transmits an infrared signal to the outside based on the control signal received from the controller **420**.

Note that the infrared remote controller **400** is not a component that is essential for the video teleconference system **100**. However, the infrared remote controller **400** copes with the infrared ray communication, and thus can provide a plurality of operating methods to the user.

1-1-3-1. Operation Screen of Remote Camera

FIG. **8** is a diagram illustrating one example of a screen for operating the remote camera **200**. The screen for operating the remote camera **200** will be described with reference to FIG. **8**.

A display screen **500** shown in FIG. **8** is generated by the remote camera **200**, and is transmitted to the display device **300** via the HDMI cable **110** to be displayed on the liquid crystal display **350** of the display device **300**. Note that the display screen shown in FIG. **8** may be generated not on the side of the remote camera **200** but on the side of the display device **300**. The display screen **500** includes a camera image display region **510**, a zoom instruction buttons **520**, a direction instruction buttons **530**, a control target selection buttons **540**, and a PinP display selection buttons **550**. The various buttons **520**, **530**, . . . of the display screen **500** are operated by the operation unit **360** of the display device **300**.

Note that, in the display screen **500**, the zoom instruction buttons **520**, the direction instruction buttons **530**, the control target selection buttons **540**, and the PinP display selection buttons **550** are not essential components. When the remote camera **200** is operated by an other operation unit such as the infrared remote controller **400**, these components do not have to be provided.

The respective components of the display screen **500** will be described. The camera image display region **510** is a region in which a real time image output from the remote camera **200** is displayed.

The zoom instruction buttons **520** includes a zoom instruction button for a telephoto direction (image enlarging direction) and a zoom instruction button for a wide-angle direction (image reducing direction). The user operates the operation unit **360** of the display device **300** to presses down any one button of the zoom instruction buttons **520**, thereby instructing the remote camera **200** to perform the zooming in the telephoto direction or the wide-angle direction. When receiving the zooming instruction by the operation of the operation unit **360**, the controller **310** instructs the remote camera **200** to perform the zooming via the HDMI interface **320** and the HDMI cable **110**. The controller **210** of the remote camera **200** performs zooming control according to the zooming instruction form the display device **300**. Then, the remote camera **200** transmits an image on which the content of the zooming instruction are reflected, to the display device **300** via the HDMI interface **260** and the HDMI cable **110**. As a result, an image in which the zooming instruction content is reflected is displayed on the camera image display region **510**.

The direction instructions button **530** includes change instruction buttons for up, down, right and left directions. The user operates the operation unit **360** to press down the button for any direction in the direction instruction buttons **530**, thereby can change a position of a subject to be photographed by the remote camera **200**.

The control target selection buttons **540** is buttons for setting the main screen or the PinP screen as a target to be controlled by the zoom instruction buttons **520** and the direction instruction buttons **530**. The user operates the operation unit **360** of the display device **300** to press down any one of a main screen button and a PinP screen button in the control target selection buttons **540**. As a result, the main image or the PinP image, to which the instruction for the remote camera **200** based on the zoom instruction button **520** or the direction instruction button **530** is applied, can be selected.

The PinP display selection buttons **550** is buttons for switching PinP display between ON and OFF. When the user operates the operation unit **360** to select "ON" for the PinP display, a synthesized image obtained by superimposing the

PinP image on an upper right of the main screen is output from the remote camera **200** to the display device **300**. As a result, the synthesized image (PinP image) output from the remote camera **200** is displayed on the camera image display region **510** of the display screen **500**. When "OFF" for the PinP display is selected, the PinP image is not superimposed, and only the main screen is output from the remote camera **200** to the display device **300**. As a result, only the main screen is displayed on the camera image display region **510**.

1-2. Operation

The operations of the video teleconference system **100** according to the first embodiment will be sequentially described.

1-2-1. Operation at Time of Operating the PinP Display Selection Button

FIG. **9** is a flowchart illustrating an operation at a time when the PinP display selection buttons **550** are operated on the display screen **500** shown in FIG. **8**. The operation at the time when the PinP display selection buttons **550** are operated will be described with reference to FIG. **9**.

The controller **310** of the display device **300** monitors the operation (ON/OFF) on the PinP display selection buttons **550** by the user (S**600**). When the user operates the PinP display selection buttons **550** to press down the button for instructing "OFF" for PinP image (NO at step S**600**), the controller **310** of the display device **300** transmits an instruction for outputting only the main image without outputting of the PinP image (the instruction for PinP display OFF) to the remote camera **200** via the HDMI interface **320**. Note that the instruction for ON/OFF of the PinP display may be issued to the remote camera **200** from the display device **300** via the HDMI interfaces **320** and **260**, or may be issued by using the infrared remote controller **400** via the infrared ray receiver **270** attached to the inside of the remote camera **200**.

When receiving the instruction to switch OFF the PinP display, the controller **210** of the remote camera **200** writes only data of the main image in the output image storage region **250***b* of the memory **250**, and then outputs the data of the main image written into the output image storage region **250***b* to the display device **300** via the HDMI interface **260**.

The controller **310** of the display device **300** displays an image indicated by the image data input from the remote camera **200** via the HDMI interface **320** (the main screen without the PinP image) on the camera image display region **510** of the liquid crystal display **350** (S**610**).

On the other hand, when the button instructing "ON" of PinP image in the PinP display selection button **550** is pressed down (YES at step S**600**), the controller **310** of the display device **300** transmits an instruction for outputting a synthesized image obtained by superimposing the PinP image on the main image (the instruction for switching ON the PinP display) to the remote camera **200** via the HDMI interface **320**. When receiving the instruction for switching ON the PinP display, the controller **210** of the remote camera **200** writes the main image in the output image storage region **250***b* of the memory **250** and then superimposes the PinP image on the upper right of the main image to generate the synthesized image. Thereafter, the controller **210** outputs the synthesized image written into the output image storage region **250***b* to the display device **300** via the HDMI interface **260**.

The controller **310** of the display device **300** displays the synthesized image input from the remote camera **200** via the HDMI interface **320** on the camera image display region **510** of the liquid crystal display **350** (S**620**).

Note that a position at which the PinP image is superimposed on the main image is not limited to the upper right position, and any position such as upper right, upper left, lower left, lower right positions, and so on of the screen may be selected by setting through a user's operation.

1-2-2. Operation at Time of Operating the Control Target Selection Buttons

FIG. **10** is a flowchart illustrating an operation of the display device **300** at a time when the control target selection buttons **540** are operated. The operation of the display device **300** at the time when the control target selection buttons **540** are operated is described with reference to FIG. **10**.

The controller **310** of the display device **300** monitors whether the main image button or the PinP image button is selected in the control target selection buttons **540**. A process illustrated in the flowchart of FIG. **10** is executed when any one of the main image button and the PinP image button is selected in the control target selection buttons **540**.

When the user presses down the main image button in the control target selection buttons **540** (NO at step S**700**), the controller **310** of the display device **300** transmits an instruction for setting the main image as a control target to the remote camera **200** via the HDMI interface **320** (S**705**). The controller **210** of the remote camera **200** receives the instruction for setting the main image as the control target. When being notified of the operation instruction content of the zoom instruction buttons **520** from the display device **300** in this state, the controller **210** of the remote camera **200** instructs the image processor **240** to execute the zooming process only on the main image based on the operation instruction content.

Note that the zooming process in the remote camera **200** is not limited to an electronic zooming process to be executed by the image processor **240**, and an optical zooming process may be executed by the lens **220**.

The image processor **240** of the remote camera **200** executes the process on the main image and the PinP image alternately based on the vertical synchronizing signal (VD). That is to say, at the timing at which the main image is being processed, the digital zooming process is executed, the image subjected to the digital zooming process is written into the memory **250** and is output via the HDMI interface **260**. When the direction instruction buttons **530** are operated, the controller **210** instructs the image processor **240** to change the position of the subject represented by the main image.

The image processor **240** changes the position of an image region to be adopted as the main image in a picked-up image (an image written into the picked-up image storage region **250***a* of the memory **250**) output from the CMOS image sensor **230** according to the operation of the direction instruction buttons **530** at a timing at which an image process is executed on the main image. The image processor **240** writes the image data in the changed image region into the output image storage region **250***b* of the memory **250** to output the image data via the HDMI interface **260**. The controller **310** of the display device **300** displays the image indicated by the image data input from the remote camera **200** via the HDMI interface **320** on the camera image display region **510**.

Next, a case in which the user selects the PinP image as the control target will be described. In the flowchart of FIG. **10**, when the user presses down the PinP image button in the control target selection buttons **540** (YES at step S**700**), the controller **310** of the display device **300** instructs the remote camera **200** via the HDMI interface **320** to make a range of the image represented by the main image wider (S**710**). That is to say, the controller **310** instructs the remote camera **200** to change a zoom position of the main image to the wide-angle end (S**710**).

When the PinP image is the control target, the user operates the zoom instruction buttons **520** or the direction instruction buttons **530** to be capable of setting any image region in the

entire region of the picked-up image as the PinP image. The controller **210** widens the range of the image represented by the main image (namely, change the zoom position to the wide-angle ends) when the PinP image becomes the control target, thereby the user easily understands a present or future setting position of the PinP image. That is to say, the main image is changed into an image of the widest angle, so that the user easily understands a relative positional relationship of the PinP image in the entire picked-up image region. Therefore, the user easily understands the position of the PinP image region in the picked-up image region that is currently set. Further, the user easily understands a position in the picked-up image region to which the PinP image may be set.

In the present embodiment, the zoom position is changed to the wide-angle end for further understanding of the user at the time of operating the setting position of the PinP image. However, the zoom position does not have to be changed to the wide-angle end. The zoom position may be shifted to cause a field angle of the PinP image to be a field angle on the side of the wider-angle end than the field angle of the main image displayed just before the PinP image is set as the control target. Even such a method makes the user easily understand the relative positional relationship of the PinP image in the entire picked-up image region.

When receiving the instruction for changing the zoom position of the main image to the wide-angle end, the controller **210** of the remote camera **200** instructs the image processor **240** to zoom the main image to the wide-angle end. At a timing where the image process is executed on the main image, the image processor **240** executes the zooming process to move the zoom position to the wide-angle end, writes picked-up image data into the memory **250**, and outputs the image data via the HDMI interface **260**. The display device **300** obtains the synthesized image including the main image with zoom position changed to the wide-angle end, from the remote camera **200** via the HDMI interface **320** (S**720**).

Then, the controller **310** of the display device **300** displays the synthesized image obtained from the remote camera **200** via the HDMI interface **320** on the camera image display region **510** of the liquid crystal display **350** (S**730**). As a result, the synthesized image by which the user easily understands the region and the position of the PinP image (namely, the PinP image is easily controlled) is displayed on the display device **300**.

In this state, the controller **310** of the display device **300** monitors whether the zoom instruction buttons **520** and the direction instruction buttons **530** are operated (S**740**). When the zoom instruction buttons **520** or the direction instruction buttons **530** are operated (YES at step S**740**), the controller **310** issues an instruction to the remote camera **200** according to the operation content (S**750**).

For example, when the zoom instruction buttons **520** are operated, the controller **310** instructs the image processor **240** of the remote camera **200** to execute the zooming process not on the main image but only on the PinP image. The image processor **240** executes the digital zooming process on PinP image for only a period for which the image process is executed on the PinP image. Then, the image processor **240** writes the synthesized image including the PinP image that has undergone the digital zooming process into the output image storage region **250***b* of the memory **250**. Thereafter, the synthesized image is output via the HDMI interface **260**.

Similarly in the case where the direction instruction buttons **530** are operated, the controller **310** instructs the image processor **240** of the remote camera **200** about a new reading position of the PinP image in the image region of the picked-up image. The image processor **240** changes the reading position of the PinP image in the picked-up image region based on the vertical synchronizing signal for a period where the image process is executed on the PinP image. The image data on the changed read position is written into the memory **250** to be output via the HDMI interface **260**.

The controller **310** of the display device **300** displays an image indicated by the image data received from the remote camera **200** via the HDMI interface **320**, on the camera image display region **510**.

In this state, the controller **310** of the display device **300** monitors whether the main image is selected as the control target (S**760**). The controller **310** of the display device **300** repeats the operations at step S**730** to step S**760** until the main image is again selected as the control target, namely, while the PinP image is selected as the control target.

Thereafter, when the main image is selected as the control target (YES at step S**760**), the controller **310** of the display device **300** instructs the remote camera **200** to return the main image again to a field angle before step S**700** (S**770**). Then, the controller **310** of the display device **300** receives the image data including a main image of the previous field angle (the main image photographed at the previous zoom position) from the remote camera **200**, and displays an image indicated by the received image data on the camera image display region **510** (S**780**). In this manner, the setting of an image region in the image region represented by the picked-up image as the PinP image is completed.

FIGS. **11**A to **11**E are diagrams describing screen transition at a time when the control target selection buttons **504** are operated. The screen transition at the time when the control target selection buttons **540** are operated is described below with reference to FIGS. **11**A to **11**E.

FIG. **11**A is a diagram illustrating an example of the screen displayed on the camera image display region **510** while a main image **800** is being selected as the control target and display of the PinP image **810** is being selected to be OFF. At this time, since the display of the PinP image **810** is selected to be OFF, the PinP image **810** is not displayed on the camera image display region **510**. Further, since the main image **800** is selected as the control target, the user operates the zoom instruction buttons **520** or the direction instruction buttons **530** to be capable of setting an image region in the entire image region of the picked-up image as the main image.

FIG. **11**B illustrates the screen that is changed from the screen in FIG. **11**A. FIG. **11**B is a diagram illustrating a screen example when the main image **800** remains selected as the control target and the display of the PinP image **810** is selected to be ON. At this time, since the display of the PinP image **810** is selected to be ON, the camera image display region **510** displays a synthesized image obtained by superimposing the PinP image **810** on the main image **800**.

FIG. **11**C illustrates the screen that is changed from the screen in FIG. **11**B. FIG. **11**C is a diagram illustrating a screen example when the display of the PinP image **810** remains selected to be ON and the PinP image **810** is selected as the control target. At this time, in association with the selection of the PinP image **810** as the control target, a broken line frame **820** is superimposed to be displayed on the main image **800**. The broken line frame **820** indicates a region in the image region of the main image **800** that is read as the PinP image **810**. This broken line frame **820** enables the user to understand an image region in the image region represented by the main image **800** that is set as the PinP image **810**. Further, in association with the selection of the PinP image **810** as the control target, the field angle (zoom position) of the image region represented by the main image **800** shifts to the wide-angle end. As a result, the user easily understands a

position of the image region in the picked-up image currently set as the PinP image, and an image region in the picked-up image to which the setting position as the PinP image is changed. In a state where the screen of FIG. **11**C is displayed, the user can set a region of the PinP image in the region of the main image of a wider field angle.

FIG. **11**D illustrates the screen that is changed from the screen in FIG. **11**C. In FIG. **11**D, the display of the PinP image **810** remains selected to be ON and the PinP image **810** remains selected as the control target. In FIG. **11**D, the broken line frame **820** indicating the setting position of the PinP image is transferred from the position shown in FIG. **11**C by the operation of the direction instruction buttons **530**. At this time, in association with the transfer of the position of the broken line frame **820** indicating the setting position of the PinP image, the display content of the PinP image **810** changes. As a result, the user easily understands how the display content of the PinP image **810** changes while transferring the setting position of the PinP image. Further, at this time, since the PinP image **810** remains selected as the control target, the field angle (zoom position) of the image region represented by the main image **800** is maintained at the wide-angle end. As a result, the user can transfer the PinP reading position while understanding the image region in the picked-up image to which the setting position as the PinP image may be changed.

FIG. **11**E illustrates the screen that is changed from the screen shown in FIG. **11**D. FIG. **11**E is a diagram illustrating the screen when the display of the PinP image **810** remains selected to be ON, but the control target is changed from the PinP image **810** into the main image **800**. In association with the change of the control target from the PinP image **810** into the main image **800**, the frame **820** indicating the setting position of the PinP image is not displayed. Further, in association with the change of the control target from the PinP image **810** into the main image **800**, the operation for setting the setting position of the PinP image is regarded as completed, and the field angle (zoom position) of the image region represented by the main image **800** is returned to the field angle (zoom position) just before the PinP image **810** is selected as the control target. With the above method, a intended image region can be set as the PinP image in the image region represented by the picked-up image.

1-2-3. Operation at Time of Switching Aspect Ratio

FIG. **12** is a flowchart illustrating operations for switching an aspect ratio in image output via the HDMI interface. The operations for switching the aspect ratio of the image in HDMI output will be described with reference to FIG. **12**.

The controller **210** of the remote camera **200** monitors whether the aspect ratio of the main screen is changed (S**900**). The user can switch the aspect ratio of the output image in the HDMI output through menu operations of the remote camera **200**. When the aspect ratio of the remote camera **200** is changed (YES at step S**900**), the controller **210** of the remote camera **200** instructs the image processor **240** of the remote camera **200** to shift the superimposing position for the PinP image (S**910**).

Herein, a case in which the output aspect is changed into 4:3 sidecut while the output aspect is set to 16:9 and the PinP image is displayed on the upper right end of the image region represented by the main image will be described. At this time, the position at which the PinP image is superimposed is transferred to the inner side in the image region represented by the main image. Specifically, the image processor **240** transfers the position of PinP image to the inner side by at least a width of the sidecut in order to avoid a state that the PinP image superimposed on the main image is not displayed due to 4:3 sidecut. The image processor **240** executes this process at the timing at which the image process is executed on the PinP image. When the PinP image is superimposed on the main image to be written into the output image storage region **250***b* of the memory **250**, the image processor **240** shifts the writing position of the PinP image. Specifically, the writing position of the PinP image is shifted to the center side of the screen by the width for eliminating a portion that is not displayed due to the sidecut to write the PinP image. The controller **210** of the remote camera **200** reads a synthesized image obtained by the main image and the PinP image shifted to the inner side of the screen and written from the output image storage region **250***b* of the memory **250**, and provides a side black to the right and left of the screen to output the synthesized image via the HDMI interface **260**.

The controller **310** of the display device **300** obtains the synthesized image provided with the side blacks on the right and left of the screen from the remote camera **200** via the HDMI interface **320** (S**920**).

Then, the controller **310** displays the synthesized image obtained from the remote camera **200** on the camera image display region **510** of the liquid crystal display **350** (S**930**).

As described above, when the output aspect ratio is switched, the display position of the PinP image is shifted. Note that, when the aspect ratio is changed from 4:3 into 16:9, the display position of the PinP image may be shifted to the outside.

FIGS. **13**A and **13**B are diagrams describing screen transition at a time when the aspect ratio of the output image is switched. FIG. **13**A is a diagram illustrating an example of the screen when the output aspect is set to 16:9. On the other hand, FIG. **13**B is a diagram illustrating an example of the screen when the output aspect in the state of FIG. **13**A is changed into 4:3 sidecut. As shown in FIG. **13**B, when the output aspect is changed into 4:3 sidecut, the position of the PinP image is transferred so that the image region of the PinP image to be superimposed on the main image is not overlapped with the sidecut. As a result, the state that the PinP image is not displayed due to sidecut can be avoided.

The above example describes the case in which the aspect ratio is changed into 4:3 sidecut, but the change in the aspect ratio is not limited to sidecut but top/bottom cut may be used. In this case, in association with the setting change of the aspect ratio, the position of the PinP image is transferred so that the region of the PinP image to be superimposed on the main image is not overlapped with the top/bottom cut.

In the above example, the operation for switching the aspect ratio is performed on the side of the remote camera **200**, but the display device **300** may instruct the switching of the aspect ratio.

1-3. Effects or the Like

As described above, the display device **300** is a display control device for controlling a video image to be displayed on the liquid crystal display **350**. The display device **300** has the controller **310** for generating an image including the main image and the PinP image superimposed on the main image to display the image on the liquid crystal display **350**. When a mode for setting the main screen as the control target (first mode) is set, the controller **310** performs control to display the main image of a predetermined field angle (first field angle) on the liquid crystal display **350**. Note that, in the first mode, the PinP image is superimposed and displayed on the main image, but the control target is the main screen. On the other hand, when a mode for setting the PinP screen as the control target, namely, a mode for setting a region of PinP image in the region of the main image (second mode) is set, the controller **310** performs control to display the main image

of a wider field angle on the liquid crystal display **350**. As a result, the user easily understands a present set position of the PinP image and a position of the PinP image to be set later in a region of the picked-up image.

Further, the controller **310** sets an image region narrower than the image region represented by the picked-up image as the main image, and sets a predetermined region in the image region represented by the picked-up image as the PinP image. Then, the controller **310** performs control to display a synthesized image obtained by superimposing the set PinP image on the set main image on the liquid crystal display **350**. As a result, the image region outside the image region represented by the main image displayed on the liquid crystal display **350** can be set as the PinP image.

Further, the display device **300** obtains the main image and the PinP image, and may determine a position in the obtained main image at which the obtained PinP image is superimposed on the main image according to the aspect ratio of the image region to be a display region on the liquid crystal display **350**. The synthesized image obtained by superimposing the PinP image on the main image may be displayed on the liquid crystal display **350** based on the determined position. As a result, the state that the writing position for the PinP image is not displayed due to the setting change in the aspect ratio of the output image can be avoided.

Other Embodiments

As described above, as the illustration of the arts disclosed in the present application, the first embodiment is described. However, the arts in the present disclosure are not limited to this, and can be applied also to embodiments in which modifications, replacements, additions, and omissions are suitably carried out. Further, the respective components described in the first embodiment may be combined so that a new embodiment can be provided. Therefore, other embodiments will be illustrated below.

The above embodiment described the example in which one PinP image is superimposed on the main image, but the number of PinP images is not limited to one. A plurality of PinP images may be superimposed on the main image to be displayed.

In the above embodiment, the technical idea of the PinP function is applied to the video teleconference system including the remote camera **200** and the display device **300**, but an application target is not limited to the video teleconference system. The technical idea in the above embodiment can be applied to electronic devices having the PinP function. For example, the technical idea can be applied to a combination of a monitoring camera and a device for controlling the monitoring camera.

In the above embodiment, the display device **300** contains a display device such as the liquid crystal display **350**, but does not necessarily have to have such a display device. The display device **300** may output a video signal to a display device connected externally. That is to say, the display device **300** may be any device that can control an image displayed on a display device that is provided inside or externally connected.

The main image is one example of a first image. The PinP image is one example of a second image. The controller **310** is one example of a controller. The HDMI interface **320** is one example of a communication unit. The liquid crystal display **350** is one example of a display unit. The display device **300** is one example of a display control device.

As described above, as the illustration of the arts in this disclosure, the embodiments is described above. For this purpose, the accompanying drawings and the detailed description are provided for the illustration of the arts.

Therefore, the components described in the accompanying drawings and the detailed description may include not only the components essential for solving the problem but also components that are not essential for solving the problem in order to illustrate the arts. For this reason, even if these unessential components are described in the accompanying drawings and the detailed description, these unessential components should not be immediately approved as essential.

Further, since the above embodiments illustrates the arts in the present disclosure, various modifications, replacements, additions, and omissions can be carried out within the scope of claims or an equivalent scope.

INDUSTRIAL APPLICABILITY

The idea of the present disclosure can be applied to a display control device and a display control system that control the PinP display function.

The invention claimed is:

1. A display control device for controlling a video image displayed on a display unit, comprising:

a control circuit configured to generate an image including a first image and a second image superimposed on the first image to display the image on the display unit, the second image at least partially outside or completely outside a field angle of the first image; and

a memory including a storage region for storing the image to be displayed on the display unit, wherein

the control circuit

performs control to display the first image of a first field angle on the display unit when a first mode is set, and

performs control to display the first image of a second field angle on the display unit when a second mode is set,

the second mode is a mode for setting a region of the second image in a region of the first image of the second field angle; and

the second image is selected such that the second image is at least partially outside or completely outside the first field angle of the first image.

2. The display control device according to claim **1**, wherein

in the first mode, the control circuit displays an image obtained by synthesizing the second image set in the second mode with the first image displayed at the first field angle, on the display unit.

3. The display control device according to claim **1**, further comprising:

a communication unit configured to transmit/receive digital signals to/from an imaging device so as to communicate with the imaging device, wherein

the first image is an image that is captured by the imaging device and is received from the imaging device via the communication unit,

when the first mode is switched into the second mode, the control circuit transmits an instruction for capturing an image at the second field angle to the imaging device via the communication unit.

4. The display control device according to claim **3**, wherein

the control circuit receives the first image captured at the second field angle from the imaging device via the communication unit.

5. The display control device according to claim **1**, wherein

the first image and the second image are images obtained by cutting out part of an entire region of an image captured by an imaging device.

6. The display control device according to claim 1, wherein the second field angle is wider than the first field angle.

* * * * *